

Appl. No. 10/695,236
Amdt. dated February 9, 2005
Reply to Office action of November 10, 2004

Amendments to the Drawings:

The attached drawing sheets include changes to FIGs. 1, 2A, 2B, 3, 5, 8, 9, and 12.
These sheets replace the original drawing sheets.

- 5 In FIG. 1, previously omitted element 35 has been added.
In FIG. 2A, previously omitted element 35 has been added.
In FIG. 2B, previously omitted element 35 has been added.
In FIG. 3, previously omitted element 100 has been added. Element 11 has been
renumbered as element 115.
- 10 In FIG. 5, previously omitted element 50 has been added.
In FIG. 8, previously omitted element 10 has been added.
In FIG. 9, previously omitted element 45 has been added.
In FIG. 12, previously omitted elements 125, 130, 135, 140 and 145 have been added.
- 15 Attachment: Replacement sheets
Annotated Sheet Showing Changes

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REMARKS/ARGUMENTS

The subject matter of the various claims was commonly owned at the time any inventions covered therein were made without any change to inventorship.

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In the specification, the paragraphs [0013], [0040], [0041], and [0044] have been amended to correct minor editorial problems. Paragraph [0034] is amended to add language referring to element 75 which was called out in FIG. 1 but not described in the specification. Support for this amendment is found in paragraph [0039].

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In amended FIG. 1, the previously omitted element 35 has been added. Support for this amendment is found in paragraph [0034].

In FIGs. 2A and 2B, previously omitted element 35 has been added. Support for this amendment is found in paragraph [0039]

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In FIG. 3, previously omitted element 100 has been added. Element 11 has been renumbered as element 115. Support for this amendment is found in paragraph [0040].

In FIG. 5, previously omitted element 50 has been added. Support for this amendment is found in paragraph [0041].

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In FIG. 8, previously omitted element 10 has been added. Support for this amendment is found in paragraph [0042].

In FIG. 9, previously omitted element 45 has been added. Support for this amendment is found in paragraph [0042].

In FIG. 12, previously omitted elements 125, 130, 135, 140 and 145 have been added. Support for this amendment is found in paragraph [0051].

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Claims 1-42, 51 and 52 stand as rejected under 35 U.S.C. §103(a) as being unpatentable over Pauluth et al. (U.S. Patent 6,137,576).

With respect to claims 1, 8 and 36, the Examiner asserts that "Pauluth et al. disclose the claimed invention (see Fig.1 and Fig. 7) except an optical fiber. Pauluth et

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al. teaches using an optical waveguide for sensing region that is further coupled to an optical fiber (see Fig. 1). Using an optical fiber in the sensing region would not require[d] coupling of the waveguide and the optical fiber thus providing improved coupling efficiency. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use an optical fiber in Pauluth et al. to improve coupling efficiency."

Applicants respectfully disagree. Applicants' invention is directed toward a flow cell comprising a substrate having at least one sample channel and at least one optical fiber channel holder. At least one optical fiber is disposed within each optical fiber channel holder, wherein each optical fiber has at least one grating. Each optical fiber grating is in contact with each sample channel, defining a sensing area. At least one sample port is positioned in an operable relationship to at least one sample channel. (Claim 1). The flow cell further comprises at least one sample outlet positioned in an operable relationship to at least one sample channel. (Claim 8). The sample is selected from the group consisting of: a liquid sample; a gas sample; and a complex sample. (Claim 36).

Pauluth et al. disclose optical transducers for measuring a contaminant in a gas. The contaminant interacts with a liquid crystalline phase as a sensing element in a flow cell. (Abstract and Col. 2, lines 25-32) In describing their apparatus with respect to a grating coupler, Pauluth et al. state that a "single mode waveguide 21 is on a glass substrate 22...The reflection grating coupler is equipped with a flow cell 29 with an inlet 30 and an outlet 31 for the gas to be analyzed." (Col. 7, lines 45-48 and 65-67) Hence, the sensor of Pauluth et al. is a planar sensor and incorporated into the wall of the flow cell. Applicants' invention has "an optical fiber channel holder that is designed to come into contact with the sample channel at the points along the optical fiber where each optical fiber grating is located. These points define a sensing area." (Paragraph 0034 and FIG. 1) The optical fiber channel holder "is a holder that is capable of achieving precision alignment and consistent tension on the optical fiber." (Paragraph 0034) Therefore, applicants' invention can be distinguished from that of Pauluth et al. in two

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ways. First, applicants do not rely on a liquid crystalline phase as a sensing element, but rather an optical fiber grating. In particular, applicants rely on points along the optical fiber where the optical fiber grating is used as the sensing element, not to improve coupling efficiency as asserted by the Examiner. Secondly, applicants' flow cell has an
5 optical fiber channel holder that holds the optical fiber so precise alignment and consistent tension is achieved. (Paragraph 34) "The novelty of the invention lies in the optical fiber channel holder 35 which helps the optical fiber sustain a linear shape and avoid possible distortion when it comes in contact with a sample." (Paragraph 0037) Pauluth et al. fail to disclose such a holder, and, in fact, fail to recognize the need to
10 maintain alignment and consistent tension by using a glass plate to mount the optical fiber. The sensor of Pauluth is a planar sensor incorporated into the wall of the flow cell. Therefore, because applicants' claimed flow cell does not rely on a liquid crystalline phase as the sensing element and has an optical fiber channel holder to maintain precise alignment and consistent tension on the optical fiber, applicants' claimed invention is not
15 obvious based on the teaching of Pauluth et al. and the rejection should be withdrawn.

Claim 2 stands as rejected. The Examiner asserts, "even though Pauluth et al. does not specifically teach having [a] curved sample channel, it would have been obvious to one having ordinary skill in the art to use any shape including curved shape since
20 applicant does not provide criticality of having any particular shape."

Applicants respectfully disagree. The Examiner is directed to paragraph 0035 where applicants explain the criticality of having a particular shape. Applicants state, "The sample channel is capable of being modified to achieve the desired sample delivery volume to the sensing area (preferably less than 100 microliters). The sample channel 30
25 is depicted in its preferred configuration where the sample channel is curved to provide optimal fluid flow within the sensor area. The curved shape allows the flow to be laminar, thus eliminating dead volumes." Moreover, Pauluth et al. fail to disclose the importance of having laminar flow to eliminate dead volumes. Therefore, the rejection is without merit and should be withdrawn.

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Claims 3-7 and 9-13 stand as rejected. The Examiner asserts that "Pauluth et al. show two planar mating pieces of the substrate structure not a monolithic structure. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a monolithic structure, since it has been held that forming in one piece
5 an article which has formerly been formed in two pieces and put together involves only routing skill in the art. Since Pauluth et al.'s device comprises two mating pieces; the device would inherently be interchangeable."

Applicants respectfully disagree. Claims 3-4 and 9-10 claim the flow cell as a
10 monolithic structure. Claims 5-7 and 11-13 claim the flow cell as having at least two mating pieces. These claim sets are directed towards two different embodiments. The invention in Claims 3-4 and 9-10 is a monolithic structure. Applicants assert that, "in the case of a monolithic structure, the substrate is pre-cast or a solid piece that has been bored-out to provide at least one sample channel 30, at least one optical fiber channel
15 holder 35, and at least one sample port 60." (Paragraph 0038) "The novelty of the invention lies in the optical fiber channel holder 35 which helps the optical fiber sustain a linear shape and avoid possible distortion when it comes in contact with a sample."
(Paragraph 0037) Pauluth et al. fail to disclose a monolithic structure having at least one sample channel, at least one optical fiber channel holder, a sensing area defined by an
20 optical fiber grating in contact with each sample channel, and at least one sample port. Moreover, it would not have been obvious to one of ordinary skill in the art to have a monolithic structure that contains a separate optical fiber channel holder, as claimed, because Pauluth et al. teach an optical fiber on a glass substrate that is part of the flow cell wall. Therefore, the rejection is without basis and should be withdrawn.

25 With respect to claims 5-7 and 11-13, the flow cell has at least two mating pieces. Applicants' claimed invention requires at least one optical fiber channel holder.
(Paragraph 0039 and claims 5-7 and 11-13, which incorporate the elements of claim 1.) Pauluth et al. fail to disclose at least one optical fiber channel holder and rather disclose an optical fiber on a glass substrate (column 7, lines 45-48). Therefore, it would not have

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been obvious to one of ordinary skill in the art to provide a flow cell having at least two mating pieces and at least one optical fiber channel holder.

Claims 14-24 stand as rejected. The Examiner asserts that "even though Pauluth et al. only show one of each inlet, outlet and sample channel, it would have been obvious to one having ordinary skill in the art at the time the invention was made to apply any number of inlet, outlet and sample channels, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art.

Applicants respectfully disagree. Claims 14-24 are dependent on claim 1 and, therefore, incorporate the limitations of claim 1. As stated previously, Pauluth et al. fail to disclose a flow cell having at least one optical fiber channel holder (claim 1). It is the optical fiber channel holder, coupled with the fact that the sensing area is defined by an optical fiber grating in contact with a sample channel, that distinguishes applicants' invention from that of Pauluth et al. Therefore, the rejection is without basis and should be withdrawn.

Claims 25 and 26 stand as rejected. The Examiner asserts that "a standard microtiter plate has 9mm spacing, thus having 9mm spacing between sample channels would have been obvious in Pauluth et al."

Applicants respectfully disagree. Claims 25 and 26 are dependent on claim 8, which is dependent on claim 1. Therefore, claims 25 and 26 incorporate the limitations of claims 1 and 8. Pauluth et al. fail to disclose that the apparatus of their invention can be used in a microtiter arrangement. In addition, Pauluth et al. fail to disclose a flow cell having an optical fiber channel holder. Therefore, based on the teaching of Pauluth et al. it would not have been obvious to one having ordinary skill in the art to have the claimed spacing between sample channels.

Claims 27 -35 stand as rejected. The Examiner asserts that "controlled delivery of the sample using various ways into the flow cell would have been obvious to one having

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ordinary skill in the art at the time the invention was made in order for the user to control the test for different applications.”

Applicants respectfully disagree. Claims 27-35 are dependent on claim 1 and thus incorporate the features of claim 1. Therefore, for the reasons previously stated, the invention as claimed in claims 27-35 would not have been obvious to one having
5 ordinary skill in the art.

Claims 37-40 and 42 stand as rejected. The Examiner asserts that “even though Pauluth et al. do not teach that the grating is a long period or Bragg grating, these are well known types of grating[s] that are used in the art. Thus it would have been obvious to
10 one having ordinary skill in the art at the time the invention was made to use any gratings including long period or Bragg gratings (since applicant does not provide the criticality of having any particular grating) in Pauluth et al. as long as the grating detects the sampled being tested.”

Applicants respectfully disagree. Claims 37-40 and 42 are dependent on claim 1 and therefore incorporate the limitations of claim 1. Pauluth et al. fail to disclose a flow cell having an optical fiber channel holder nor would it be obvious in view of the teaching of Pauluth et al. to arrive at applicants’ claimed invention for the reasons stated above. Therefore, the rejection is without basis and should be withdrawn.
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Claims 51 and 52 stand as rejected. The Examiner asserts that “since Pauluth et al. show two mating pieces that are put together to make a flow cell, one with ordinary skill in the art would recognize having means to connect all mating pieces together in Pauluth et al. in order to hold the pieces together.”
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Applicants respectfully disagree. Claim 52 is dependent on claim 51. Claim 51 is directed toward a flow cell kit comprising an upper substrate having at least one sample channel and at least one sample port. An optical fiber channel holder has at least one optical fiber having a grating disposed therein. The optical fiber channel holder has a means to connect to the upper substrate. There is also a lower substrate having a means to connect to the optical fiber channel holder on a side opposite from the upper substrate.
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Hence, there are three pieces: an upper substrate; at least one optical fiber channel holder; and a lower substrate. (Claim 51). Claim 52 adds the limitation that the upper and lower substrates each have a means to interconnect with each other. Pauluth et al. fail to disclose a flow cell kit having three pieces. Rather, their flow cell arrangement fails to have a separate optical fiber channel holder. Therefore, it would not have been obvious to one of ordinary skill in the art to arrive at applicants' claimed invention. Therefore, the rejection is without basis and should be withdrawn.

Applicants' bring to the Examiner's attention the reference of Pilevar et al. (US 6,558,958) cited as art made of record and not relied upon by the Examiner. Pilevar et al. disclose "a holder 201 used to prevent the fiber 101 from bending, breaking, or sticking to the walls of a flow cell (not shown)." (Figure 2 and Col. 5, lines 38-40) However, Pilevar et al. fail to disclose the flow cell configuration. Applicants' invention is distinguished from that of Pilevar et al. because Pilevar et al. fails to disclose a substrate having at least one sample channel and at least one optical fiber channel holder, an optical fiber having at least one grating disposed in the optical fiber channel holder, wherein each optical fiber grating is in contact with each sample channel defining a sensing area; and at least one sample port positioned in an operable relationship to at least one sample channel. (Claim 1) The optical fiber in applicants' invention is only exposed to the sample "at the points along the optical fiber where each optical fiber grating is located." (Paragraph 0034) In addition, combining the teaching of Pilevar et al. with that of Pauluth et al. would fail to render the present invention as obvious because neither reference discloses a flow cell having at least one sample channel and at least one optical fiber channel holder, and a sensing area defined by an optical grating in contact with each sample channel. Rather, were one of skill in the art to combine the optical holder of Pilevar et al. in the flow cell of Pauluth et al., one would have a flow cell where the optical fiber runs through the sample channel. There is no separate and distinct sensing area as there is in the present claimed invention.

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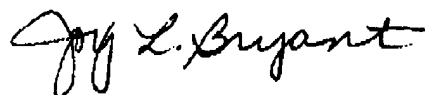
In view of the examiner's earlier restriction requirement, applicant retains the right to present claims 43-50 in a divisional application.

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CONCLUSION

In view of the above Amendments and Remarks, it is submitted that claims 1-42,
51 and 52 are in condition for allowance. Reconsideration and withdrawal of the
5 rejections are requested and allowance of the claims at an early date is solicited.

Respectfully submitted,



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20 Attachments

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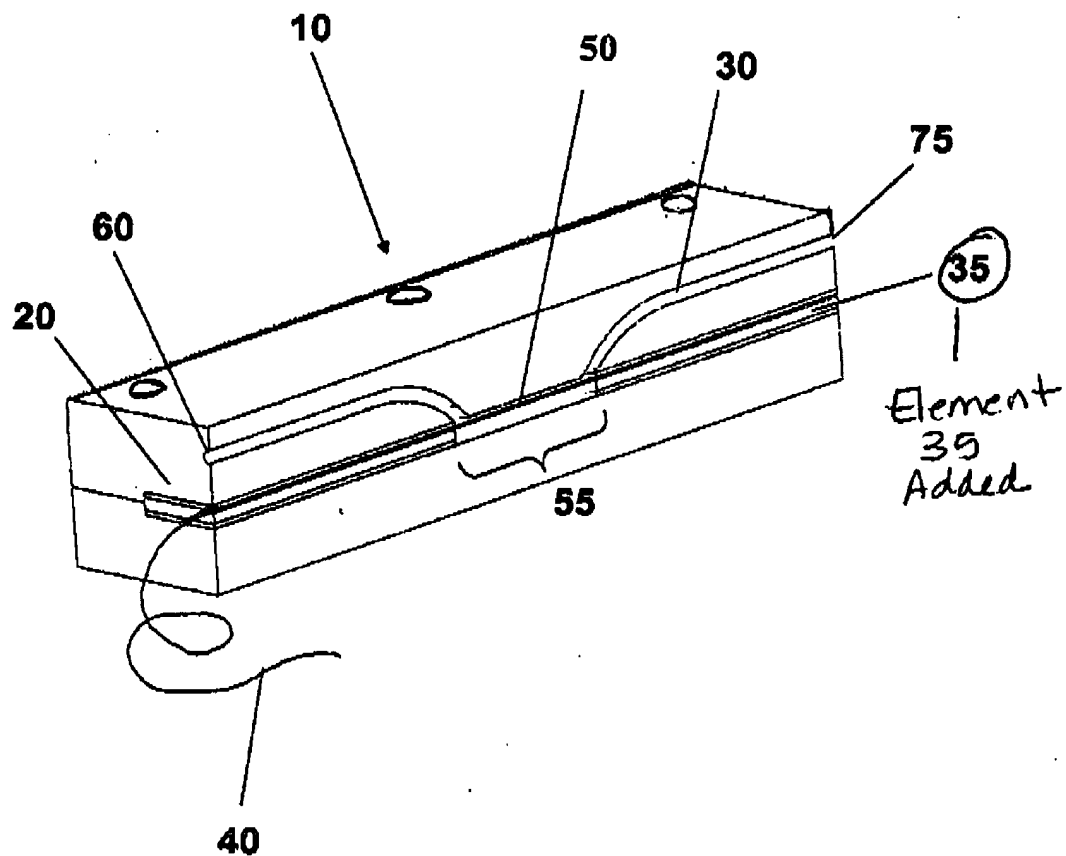
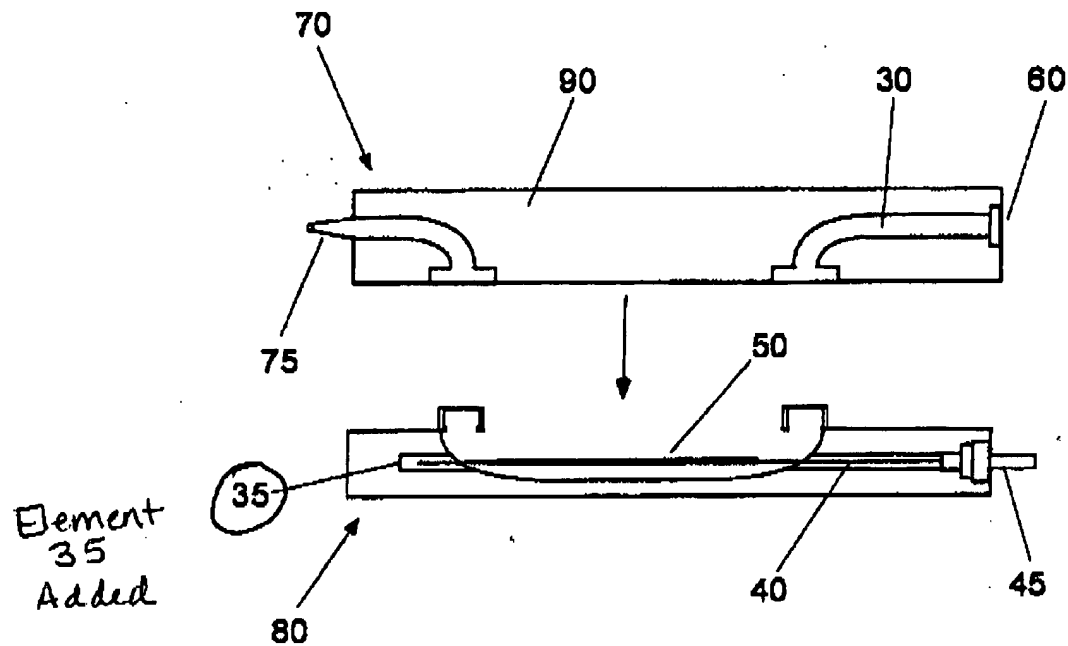
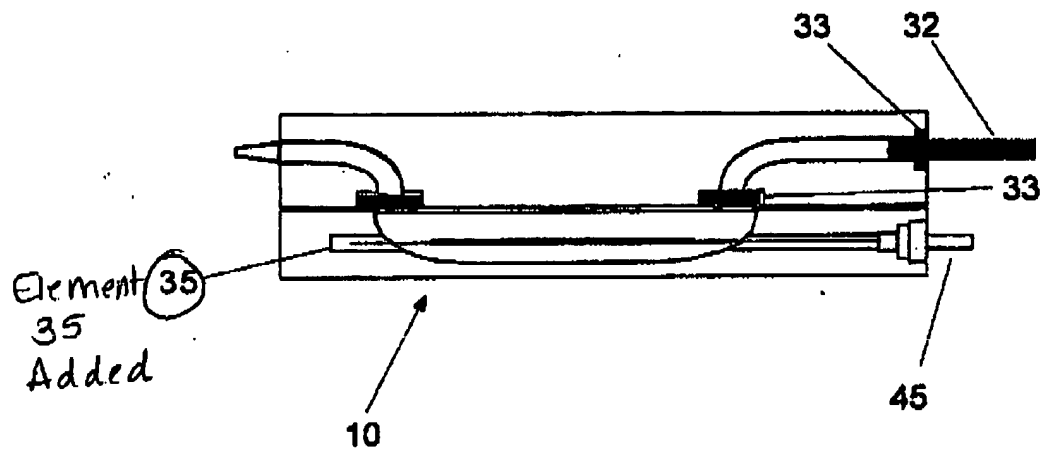


FIG. 1

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**FIG. 2A.****FIG. 2B.**

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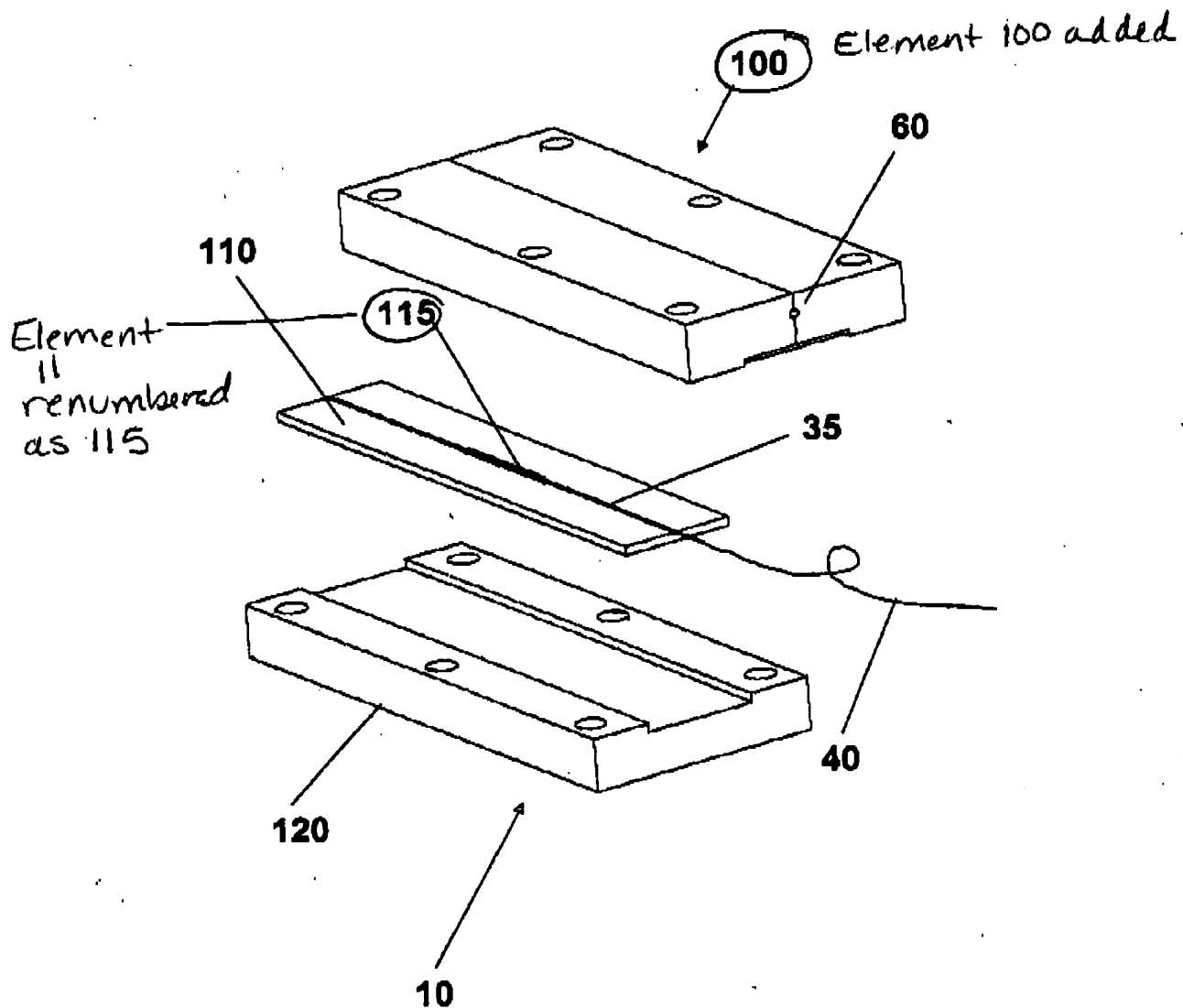
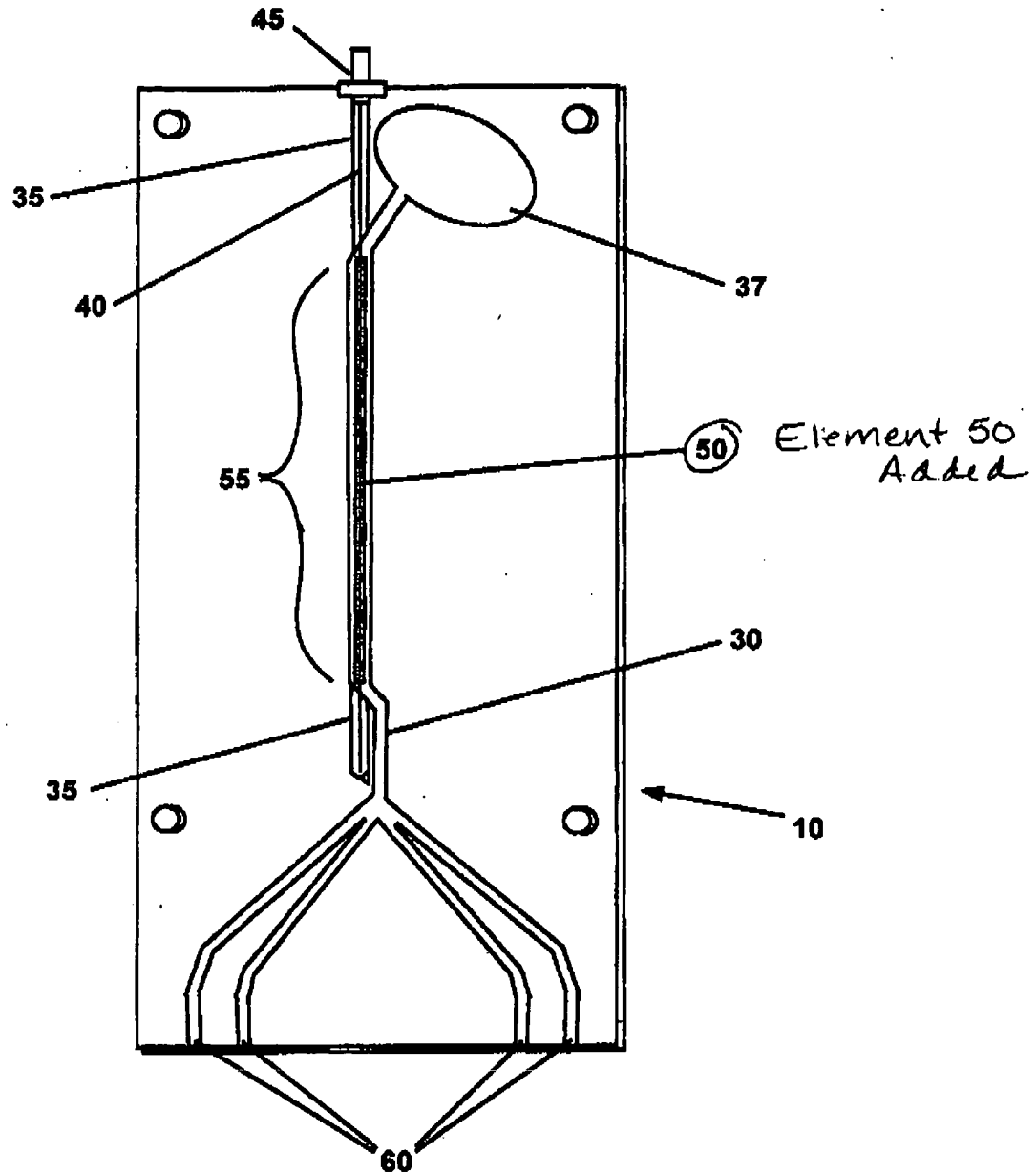


FIG. 3.

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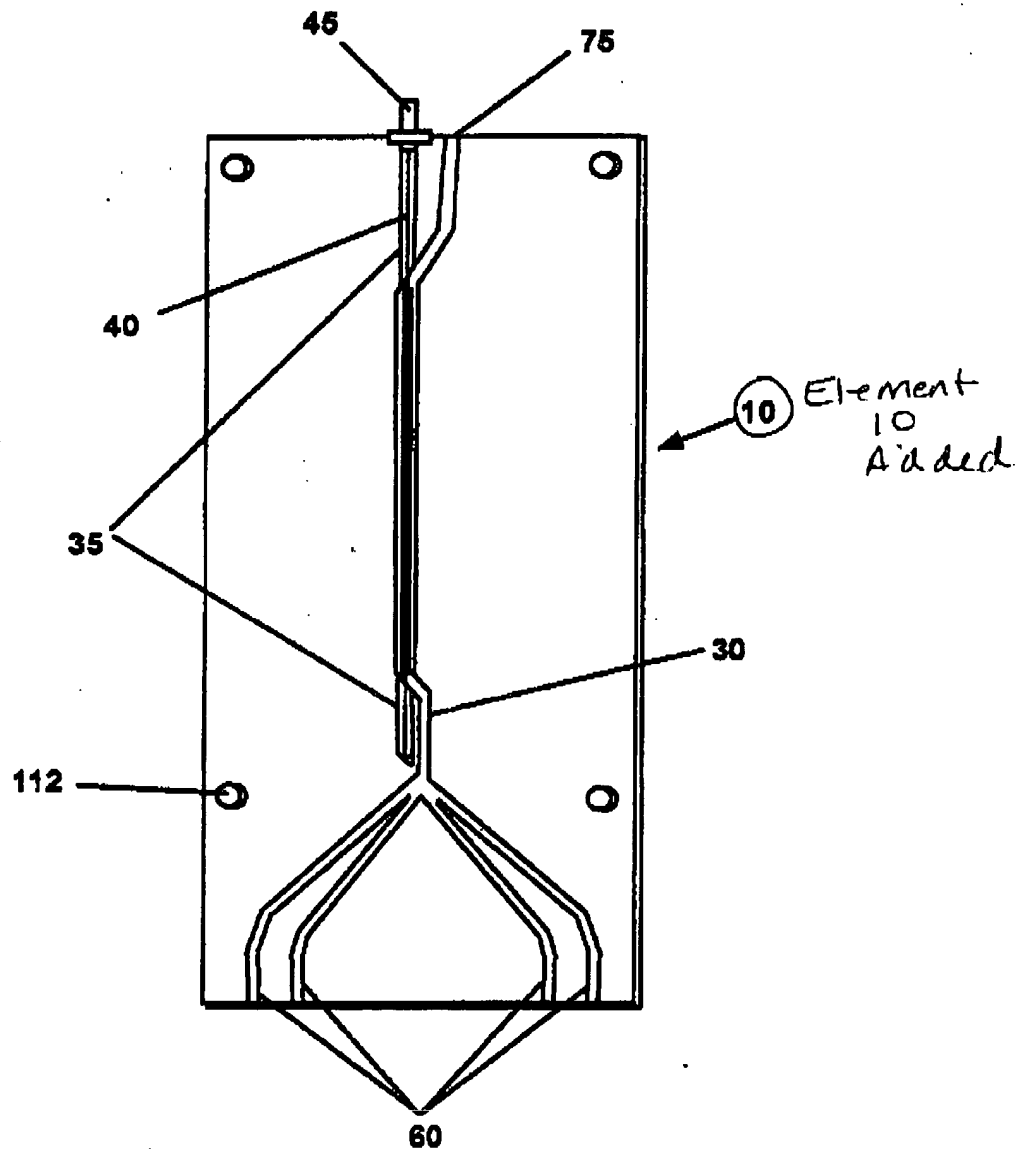
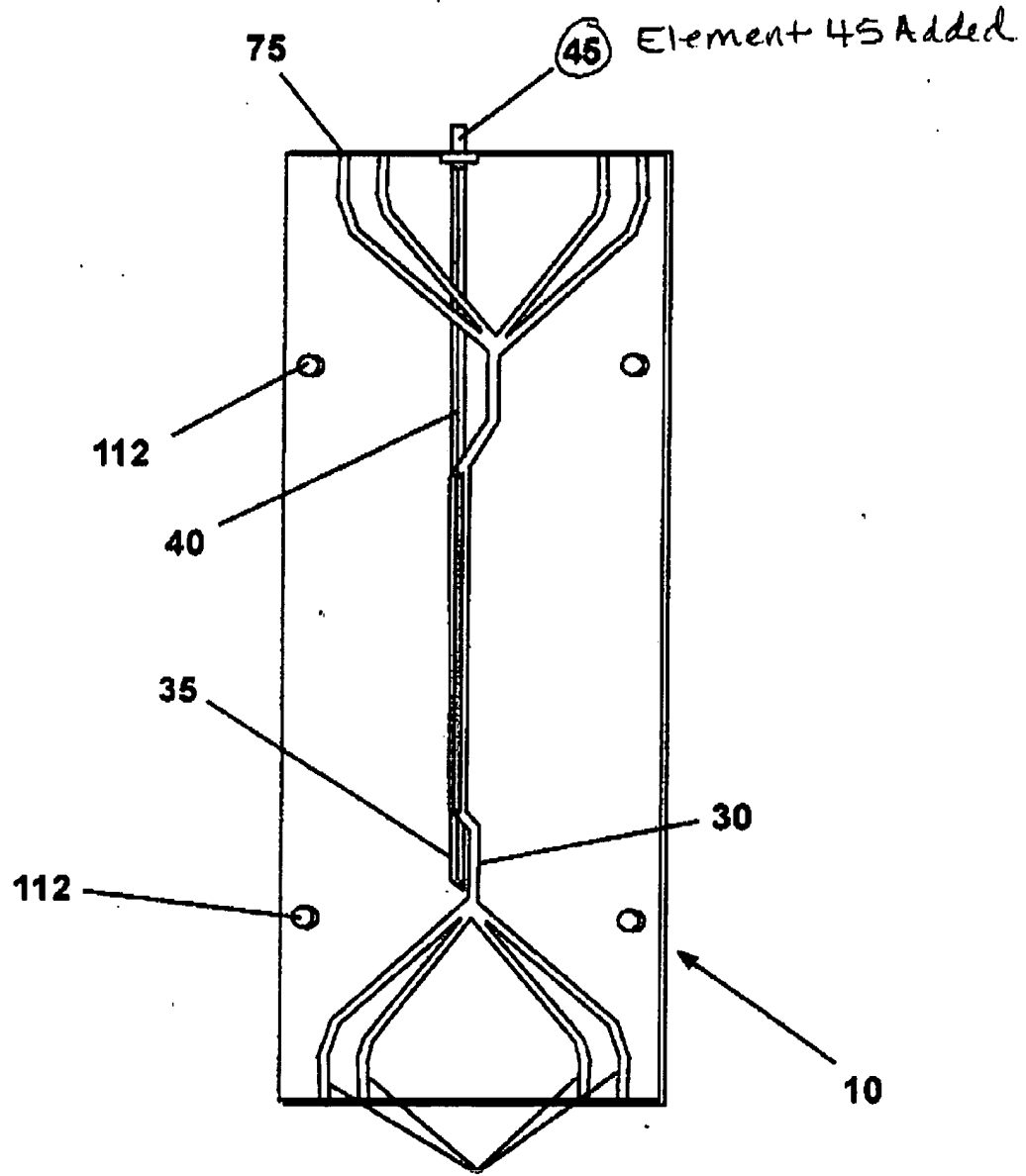


FIG. 8.

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FIG. 9.

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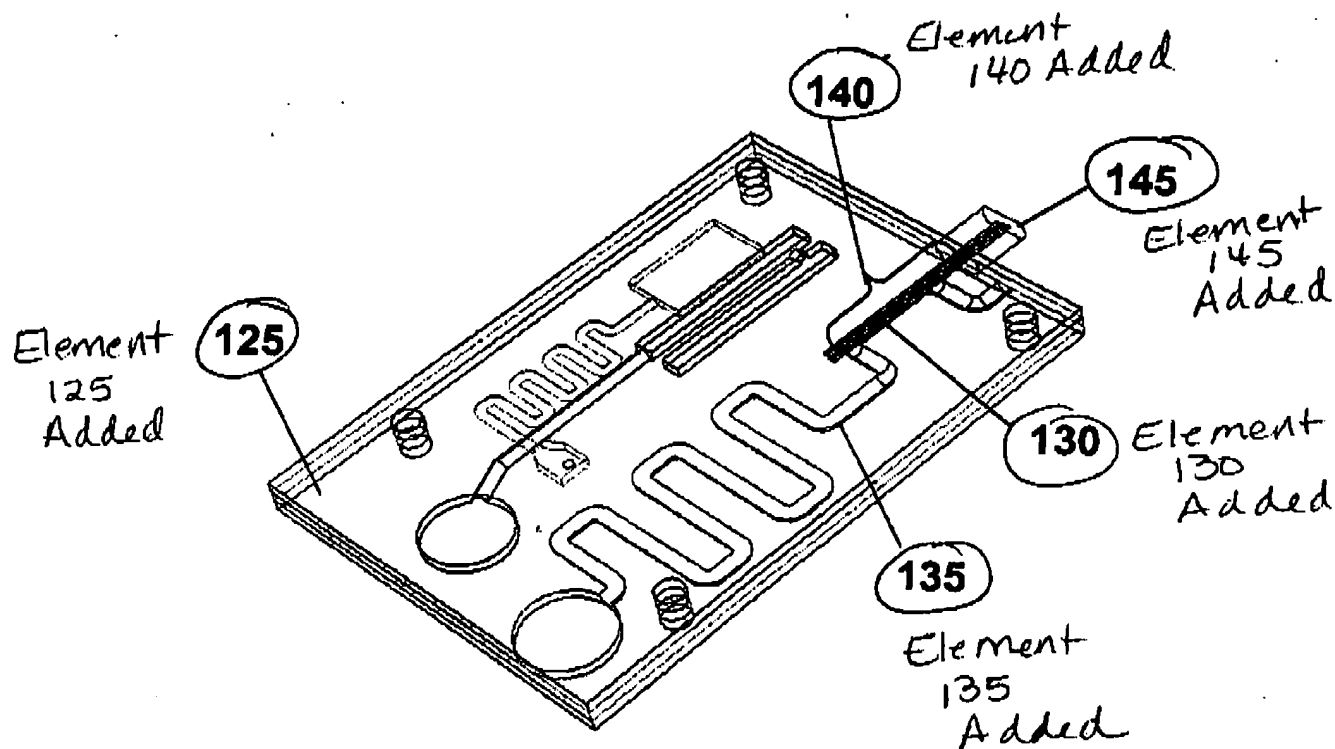


FIG. 12.